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THE GARBAGE CRISIS: TRADITIONAL SOLUTIONS

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INTRODUCTION

As long ago as 500 BC, the city state of Athens decreed that wastes must be transported beyond the city gates for disposal. While the challenge of waste disposal has confronted mankind for millennia, the problem has become acute only within the past few decades and is primarily localized in the developed world. In essence, garbage is a by-product of prosperity.

For most of Canada's history, garbage disposal was not a concern. Wide open spaces, a sparse, largely agrarian

population, and the strong ethic of "waste not, want not" precluded the need for centralized waste management in all but a few large urban centres. Frugality, coupled with a lack of readily available consumer products, meant that many used materials were mended or reworked into new goods. What was not made over was composted, burnt for heat or carted away, for example by the scrap-metal dealer and the "rags-and-bones man."

The end of World War II ushered in a new era of Canadian prosperity and the beginning of the consumer society. The rise of self-service merchandising spawned the need for new packaging materials to both protect and help sell products. Today, packaging comprises one-third of solid waste. In addition, the Canadian shift toward an industrial-based economy promoted the growth of cities and towns. Virtually all Canadian urban centres, and even villages, have weekly curb-side garbage pick-up. This service is paid for through municipal property taxes and no direct waste removal charge is levied. As a result, the real cost of managing garbage has been hidden and there has been no apparent financial incentive for the homeowner to adopt alternative forms of waste management. Today, however, many factors are conspiring to provoke citizen resistance, slowing the Canadian shift to a "disposable society." Many people simply do not feel comfortable about the huge volumes of garbage they tote to the curb each week. Others realize that much of their "waste" retains some value (energy, fibre, metal) and they feel guilty that it is being entombed in landfills.

For much of this century, a large portion of urban waste was incinerated. The municipal incinerators were simple furnaces lacking today's high-technology pollution control devices. Neighbourhoods near an incinerator were often subjected to air pollution in the form of smoke and the deposition of particulate matter. Worse, soil analyses in areas close to incinerators have indicated heavy metal and dioxin contamination. The discovery of compounds that pose a potential health hazard resulted in the closure of old incinerators and prompted strong public resistance to their replacement by new state-of-the-art incinerators.

Landfills also engender feelings of aversion, for, like their predecessor, the town dump, they are believed to be dusty, smelly, smoky and vermin-infested. In addition to aesthetic concerns, there is the worry that liquid wastes may seep from the dump site and compromise ground water quality. Finally, it is widely believed that available landfills will soon be used up and that there is no room for new landfills. This view is only partially correct; landfill space is at a premium but there are still numerous possible sites. The problem is that no one wants to leave near a landfill. In addition to the possible damage to the aesthetic environment, a landfill leads to increased neighbourhood truck traffic. As well, there is resentment and injured pride to contend with, as no community wants to be seen as the dumping ground for someone else's garbage. Probably of most concern is the fact that property values tend to decrease with increasing proximity to a landfill.

THE WASTE MANAGEMENT HIERARCHY

In the early 1980s, it became apparent to municipal solid waste (MSW) managers that a garbage crisis was imminent in Canada's more heavily populated regions. Studies of effective waste management options consistently indicated that the frugal practices of a century ago held the greatest promise of lessening the need for new landfills and incinerators. These practices have been termed the "3 Rs": reduce consumption of disposable consumer products, particularly packaging materials; re-use materials wherever possible; and remake or recycle used items.

The 3 Rs are not of equal environmental benefit. Reducing the volume of goods generated and discarded is Canada's number one waste management priority. This is followed by re-use; recycling is considered the least attractive option of the three. MSW managers recognize that waste management cannot be accomplished by one means. Indeed, there will always be some materials that cannot be re-used or recycled. If these materials are combustible, it is felt they should be incinerated and the released energy used for heating or generating electricity. For non-combustible materials that cannot be re-used or recycled, landfilling remains the only waste management option.

The usually accepted waste management hierarchy (reduce, re-use, recycle, incinerate, landfill) does not necessarily hold for all Canadian municipalities. Recycling is of economic and environmental benefit in Ontario's Golden Horseshoe, but it makes little economic sense in Rankin Inlet. In Kirkland Lake, where a large percentage of the waste stream is wood debris, incineration and generation of electricity is the favoured waste management option.

A. Reduce

"Reduce" means reducing the amount of waste produced at the source. The consumer can contribute to source reduction by living more simply, by choosing not to buy or accept disposable products or packaging, and by complaining to manufacturers about over-packaging. The manufacturer can design new products with waste reduction in mind, use lighter weight packaging or none at all, and improve industrial processes so that they do not produce as much waste. Action on this front, however, has not been sufficient to stem the ever increasing volume of waste generated in Canada and it is recognized that future success depends on the development of provincial and national waste reduction policies.

In 1988, the Canadian Council of Ministers of the Environment (CCME) studied this issue and, in 1989, set a nation-wide waste reduction goal of 50% for the year 2000. In quantitative terms, this means that the 1.8 kg of waste generated per person per day in 1988 is to be reduced to 0.9 kg. To help achieve this goal, the CCME, in

consultation with all the provinces and territories, the federal government, municipalities, industries, and environmental groups, developed the *National Packaging Protocol*. At present, this is a voluntary program that involves consumers, retailers and manufacturers; however, the protocol states that regulations will be implemented if necessary to ensure compliance with protocol policies. A national packaging monitoring system has been established to measure progress towards the stated objectives of a 20%, 35% and 50% reduction in packaging sent for disposal (incineration or landfill) by 31 December 1992, 1996 and 2000, respectively. It should be noted that in the *National Packaging Protocol* "reduction" means any action that reduces the amount of material going to incinerators or landfills; thus, the re-use or recycling of material counts as reduction.

B. Re-use

"Re-use" implies using an item repeatedly rather than throwing it away. The most familiar form of re-use is the refillable return-for-deposit beer bottle. As well, organizations such as the Salvation Army run long-established repair and re-use systems for clothing, furniture and appliances. Parts taken from old automobiles and appliances are examples of items that are re-used.

Re-use results in significant reduction at source. When old parts that are operational are used again, there is a decreased need for the manufacture of new parts; natural resources in the form of virgin materials and energy expended in manufacturing are saved, while the associated emissions to air, soil and water are eliminated. Using refillable containers has an additional environmental advantage over recycling used packaging. When purchasing beer, the consumer brings back used bottles to the beer store in the same trip; and after delivering beer to the store, the empty truck carries the used bottles back to the brewery for washing and refilling. In other words, there are no extra trips and thus there is an economy of transportation. In contrast, recycled materials have to be picked up at curbside by specially equipped trucks, or be taken by the homeowner in a special trip to a neighbourhood recycling depot, from where they are trucked to a recycling centre. Following sorting and baling, the materials are then transported to a reprocessing plant anywhere from a few to thousands of kilometres away.

Given the energy and environmental advantages of re-use over recycling, it may seem unusual that governments at all levels have not facilitated material re-use schemes by means of regulation or subsidies. The reason is that the North American system of long-distance one-way distribution of goods does not encourage deposit-return schemes. For example, a vegetable processing plant in Leamington, Ontario, may ship bottles of tomato juice to Calgary by means of an independent trucking company. The truck is not then available to transport low-value juice bottles back to Leamington, however; rather, its next cargo may be beef destined for Vancouver, or Japanese auto parts bound for Dallas. The deposit-return system for refillable containers is practical only for local or regional distribution of goods; for example, beer store to brewery, and, as in Great Britain, from doorstep to dairy.

Regulations to promote the re-use of materials would give independent, locally based producers a market advantage over centralized production and long-distance distribution. Indeed, large multinational companies have called the mandatory deposit and return systems a barrier to free trade.(1) During the mid-1980s, Coca-Cola Ltd. and Pepsi-Cola Canada Ltd., with a one-time $20-million set-up fund, kick-started Ontario's blue box recycling program. This encourages a product distribution system of one-way pop cans and plastic bottles, with the taxpayer carrying the cost of recycling. According to the *Financial Times of Canada*: "80% of the independent bottlers in the province were bought up or closed down as Coca-Cola and Pepsi-Cola centralized production in suburban Toronto."(2) Toronto-based Pollution Probe estimates that eliminating the need for refillable containers saves these two beverage distributors $60 to $80 million a year.(3)

Today in Canada, the dairy industry no longer supplies products in refillable receptacles, soda is primarily available in one-way plastic or aluminum containers, and increased competition from large centralized breweries in the United States has resulted in a steady decline in the Canadian beer industry's use of refillable beer bottles. The move to aluminum beer cans is most notable in western Canada. The net result is that re-use is the least successful of the 3 Rs; as a waste reduction strategy it is actually declining in importance.

C. Recycle

From an environmental point of view, re-use is clearly superior to recycling as a waste management option. In turn, however, recycling operations in the more densely populated regions of Canada and the United States have been shown to have distinct economic and environmental advantages over landfilling or incineration. The Tellus Institute, a public-interest environmental research group in Boston, studied the "full life-cycle" costs of recycling, including transport and reprocessing, and compared them with the costs of landfilling or incinerating the same waste, and the costs of making new products out of "virgin" materials. It was concluded that recycling wins out for aluminum, paper, glass, cardboard and most other recyclable wastes. The exception was plastics, which are relatively cheap to make, but expensive to recycle because, though many plastic materials look similar, they are chemically incompatible and must be sorted. This situation may be eased by the development of new technologies that depolymerize plastics to feedstock components. Recycling operations are generally most successful in populated regions where economy-of-scale results in comparatively low per capita collection costs, waste undergoes residential "pre-sorting," distances from recycling depots to reprocessing centres are short, and landfill tipping fees are high.

In Canada and the United States, a number of factors have conspired to make recycling a widespread waste management choice. The concept of recycling has been warmly embraced by the public as environmentally correct. This acceptance, plus the need to ease pressure on rapidly filling landfills, has prompted a number of governments to introduce recycling ventures and to subsidize these operations until they start to become self sufficient. Also, as mentioned, some large beverage companies have contributed funds to help kick-start regional recycling operations. A major inducement, however, has been the development of government policies and legislation that create markets for recycled materials. Many governments have established procurement policies that favour recycled products, others provide low-interest loans, grants or tax credits to companies that make products from recycled materials. In the more populous regions of the United States, in order to divert used newspapers from diminishing landfill space, many state and municipal governments have enacted legislation setting a minimum recycled fibre content for newsprint. In response, Canada's pulp and paper industry had to scramble to install paper recycling capacity in order not to lose American newsprint markets. The legislation was so effective that an increasing number of jurisdictions are now establishing recycled content standards for glass and plastic containers.

A municipal solid waste study in an Ontario region indicated that, in theory, slightly more than 60% of wastes could be recycled or composted. Recyclable wastes included paper (29.7%), plastics (8.2%), ferrous metals (5.0%), glass (2.5%), non-ferrous metals (0.8%), and compostable yard trimmings (14.7%). The balance of the waste stream was composed of hazardous waste (0.3%) and organic and inorganic wastes (38.8%) such as inert construction debris, ceramics, leather, toys, food wastes, etc. It should be noted, however, that vegetative food wastes may also be composted and diverted from landfills.

Although it may be possible to divert up to 60% of municipal solid waste from landfills, recycling rates of 40% are considered very good, even in Japan and western European countries where recycling has been on-going for many years. In Canada and the United States, recycling operations are usually diverting only somewhat more than 10% of the waste stream, though in some areas it is almost 20%. These relatively low rates are a reflection of growing pains. When a recycling program starts up, the product line is usually limited to items that are easy to collect and sort and for which there is a strong market. Accordingly, blue box operations at first collected just newspapers, metal cans and glass. Now, depending upon the area, collection has been extended to "type 1" plastics or all types of plastic and, where economy-of-scale warrants, cardboard materials. In urban Canada, most recycling operations are showing a slow but constant increase in volume and a steady move toward a better financial position.

Recycling is expensive. In most jurisdictions, the move to recycling has necessitated the purchase of a second fleet of specially designed trucks. For example, Los Angeles had to augment its fleet of 1,000 garbage trucks with 600 recycling trucks. In nearly all areas, recyclable materials are collected separately from garbage, thus doubling the distance travelled and greatly increasing fuel and labour costs. Materials must be sorted and baled at a central depot and then transported to a reprocessing plant; again incurring labour, operating and capital costs. Waste Management Inc., one of the largest waste management companies in the United States, has reported that according to its experience with 5.2 million households in 600 communities,(4) collection and sorting of for recycled material costs $175 ($227 CDN)(5) per tonne. Worse, a Pennsylvania study showed that it cost Pittsburgh residents $94 ($122 CDN) per tonne for regular MSW and $470 ($611 CDN) per tonne for recyclable material. Although Pittsburgh probably has the highest recycling cost in North America, recycling 1 tonne of material in the United States generally costs three to four times more than landfilling it. This large difference is due in part to the very low tipping fees at landfills away from the populous north-eastern seaboard, and to the higher costs of curb-side pick up of mixed recyclable materials followed by depot sorting. In contrast, the economics of recycling tend to be more favourable in Canada where tipping fees are often high and where homeowners voluntarily pre-sort recyclable materials.

Data collected by the Environmental Services Department of the regional municipality of Ottawa-Carleton provide a snapshot of a regional recycling program that is just at the point of showing economic and environmental benefits. Waste management data for 1994 is presented in Table 1. The blue box recycling program diverted 29,921 tonnes of recyclable material from landfills at a cost of $172 per tonne, or $63 per tonne more than if the material had been landfilled at $109. Leaf and yard waste was also collected, composted, and used for city parks and gardens. In addition, Christmas trees were collected and chipped and used as landscaping material. Composting and chipping diverted 8,232.5 tonnes of vegetative matter from the landfill at a cost of $77 per tonne, a savings of $32 per tonne. As a result, approximately 21% of the region's waste management budget was spent on diverting 16% of the region's waste from landfills.

Table 1: Municipal Solid Waste Management in Ottawa-Carleton

Waste Type	Tonnes	Cost $	
		Per Tonne	Per Total Tonnage
Landfill garbage	201,115	109	21,921,535
Blue box recycling	29,921	172	5,147,412
Leaf, yard waste composting and Christmas tree chipping	8,232.5	77	633,902
Total	239,268.5	-	27,702,849

The above analysis does not take into account the financial return to the private waste companies from the sale of recyclable materials. Table 2 shows the tonnages processed and the prices received by such a company: for a one-month period in early 1995, 2,852 tonnes were processed and sold for a gross income of $263,890, or $92.53 per tonne. Had the various Ottawa-Carleton municipalities not granted the private company full ownership of the collected materials, the cost of recycling might have been reduced to below the $109 cost of landfilling: $172 - ($92.53 - labour, operating and capital expenses). Many of the municipalities in Ottawa-Carleton are now renegotiating new waste contracts that claim a portion or all of the profits from the sale of recyclable materials.

Table 2: Blue Box Tonnages Processed at an Ottawa Recycling Depot

Product	Tonnes Per Month	End Market	$ Per Tonne	$ Per Total Tonnage
Newspaper	1,700	Avenor Gatineau, Quebec	62.00	105,400
Flint Glass	330	Consumer's Glass Toronto, Ontario	47.00	15,510
Coloured Glass	300	Consumer's Glass Toronto, Ontario	42.00	12,600
Tin	180	Metal Recovery Hamilton, Ontario	93.00	16,740
Aluminum	35	Alcan Oswego, New York	2,006.00	70,210
P.E.T.	20	Plastrek Bentierville, Quebec	350.00	7,000
Textiles	5	Recycling Together Ottawa, Ontario	Donated	0
Telephone Books	30	Thermo-Cell Gloucester, Ontario	0	0
Kraft Bags	55	APC Paper Co. Clairmont, N.H.	100.00	5,500
Mixed Fibre	190	MacMillan Bloedel Sturgeon Fall, Ont.	165.00	31,350
Mixed Plastic	7	Everwood Aylmer, Ontario	-60.00	-420
TOTAL	2,852			263,890

In the short term, even with improved prices and markets, it does not appear that the sale of recyclable materials will cover the cost of collection; on the other hand, sufficient revenues may be generated to make recycling less expensive than landfilling. Accordingly, in Ottawa-Carleton, recycling, composting, and tree chipping already have the potential to save both landfill space and taxpayer dollars. The economics of recycling are even better in a number of municipalities in Ontario's Golden Horseshoe. This does not imply, however, that recycling is a sensible waste management option for all municipalities.

In 1993, Ontario was the first province in Canada to make recycling mandatory in all cities and towns with a population greater than 5,000. To help establish a recycling infrastructure, the province committed $26.3 million per annum until 31 March 1996, at which time it was expected that municipalities would be running profitable recycling programs.

The northern Ontario town of Kapuskasing has a blue box program that collects cans, glass bottles and used newspapers. The newspapers are baled and transported 489 km to a paper recycling plant in Sturgeon Falls. Aluminum cans must be transported over 1,000 km to the aluminum recycling plant in Oswego, New York; and markets for glass are limited. For Kapuskasing and other isolated towns, the cost of the blue box program is greater than the cost of simply landfilling or incinerating the material. For these communities, recycling serves neither their economic nor environmental best interests. Indeed, Ontario's mandatory province-wide blue box program is in conflict with the federal government's concept of sustainable development, where decision-making is based on an analysis of economic, social and environmental considerations. In Ontario's November 1995 budget, cuts in funds

for MSW management were announced and it was suggested that municipalities might consider establishing a user-fee system for waste collection, which should make recycling costs transparent. In turn, local MSW managers should be encouraged to devise new, more cost-effective, means of complying with mandatory recycling regulations. In some towns, curb-side pick-up may cease in favour of voluntary citizen drop-off of recyclable materials at regional recycling depots. This cost-cutting action has already been taken by MSW managers in Kelowna, B.C.

ENERGY FROM WASTE

New incinerators are designed not only to burn waste, but also to recover and use the released energy. Plants are now equipped with high-temperature furnaces, scrubbers and other state-of-the-art pollution abatement systems. Combustible refuse is burned to produce steam for generating electricity, space heating, or for use in a number of industrial processes. The garbage is sorted to remove non-combustible materials or materials with a high moisture content. The remaining combustible fraction is primarily composed of paper, cardboard, plastics, wood, and rubber. Fossil fuels are the raw materials used in much of the manufacture of both plastics and tires; accordingly, these wastes possess a very high-energy value. On a weight basis, the energy content of scrap rubber is 15 to 20% greater than that of coal; capturing the energy from tires releases fewer contaminants per unit energy than burning coal at thermoelectric generating stations.(6)

In Canada, the future for new energy-from-waste incinerators is not very promising. In the recent past, garbage incinerators lacked pollution control devices and were significant sources of atmospheric pollution. Thus, today, any form of waste incineration is suspect in the eyes of the general population. State-of-the-art incinerators are extremely expensive, costing up to $650 million to build. Also, they produce an ash, which, contaminated with dioxins and various heavy metals, is classified as hazardous waste and must be disposed of in expensive, high-technology, chemically-secure landfills. Finally, incinerators and large-scale recycling programs compete for paper, plastic and other recyclables with high heating value. In urban Canada, where recycling programs are already well established and showing an environmental and economic advantage, there is little likelihood that incineration would be proposed by MSW managers or accepted by taxpayers. On the other hand, incineration must not be dismissed; in specific circumstances it is still the most sensible waste management option. For example, the energy content of used tires allows cement kilns to offset their consumption of coal without compromising environmental quality. As previously mentioned, the Ontario town of Kirkland Lake generates electricity by the incineration of waste largely composed of wood debris.

LANDFILLS

Strong public opposition thwarts the establishment of new landfill sites, particularly when a regional or "mega-dump" is proposed. Landfill sites that are properly located, constructed, operated and monitored pose virtually no health risk and cause only minimal diminishment of aesthetic environmental quality. Unfortunately, these landfills are very expensive and usually become feasible only through the economy-of-scale provided by large regional facilities. In essence, with respect to health, safety, and the maintenance of environmental quality, bigger in this case is better.

Many of the materials deposited in a landfill, such as plastics and concrete, bricks and gypsum in demolition debris, are inert; however, organic matter (paper, garden clippings, wood, food wastes) mixes with rain water and is slowly biologically degraded to a liquid waste called leachate, which contains primarily organic acids and dissolved salts and metal ions. Leachate containing organic acids, such as acetic, propionic, butyric, and lactic acids, may leak out of a landfill and contaminate ground water. A low concentration of these acids can give water an off-flavour but is not toxic. The major concern is that metals, such as cadmium, chromium, copper, lead and zinc, can become solubilized in acidic leachate, resulting in potential heavy metal contamination of ground water supplies.

In a properly constructed landfill, leachate collects at the bottom of the pit where further biological degradation converts the organic acids to methane, carbon dioxide and hydrogen gases. Carbon dioxide is inert and hydrogen is generally present at very low concentration; however, methane, unless it seeps up and out of the landfill, may pose a problem. For example, methane may become trapped and seep laterally through the earth creating an explosion hazard if it collects in the basements of nearby buildings. Accordingly, it is essential that landfills be properly constructed in order that they not pose a risk to people, animals and property.

The prime selection criteria for new landfill sites involve distance from nearest buildings, soil composition and hydrological conditions. Generally a low water table and a site with a clay under-pan barrier 4-feet thick are considered ideal. Alternatively, landfills may be constructed with a double lining of thick plastic along the bottom of the pit, which is contoured so that leachate collects in a central pool. From here, the leachate can be pumped out and put through a conventional waste-water treatment process. The treated water may then either be released over the garbage to wetten and hasten biodegradation, or discharged into municipal sewers. When sections of a landfill become full, venting pipes are drilled into the refuse mass to allow the escape of methane. Upon decommissioning, a landfill is capped with a layer of soil and the methane may be collected and flared; in the case of very large landfills, it is common practice to collect the methane and pipe it to an industrial facility for the production of process steam or electricity.

Access to modern landfills is monitored to ensure that only non-hazardous MSW is tipped. Citizens are encouraged to practise recycling, and to separate hazardous materials from their garbage for special collections or for drop off at hazardous waste collection sites. To maximize landfill space MSW is compacted; at the end of each day, the refuse is sprinkled with a layer of soil to suppress odours, discourage vermin and hasten biodegradation through the introduction of soil microorganisms. During dry periods, the facility may be sprayed with water to contain wind-blown dust. Water from a system of wells around the circumference of the landfill is routinely collected and submitted to biological and chemical testing to ensure its safety.

In many decommissioned landfill sites, the rounded soil cap apparently diverts rainfall away from the refuse below, thus greatly retarding the rate of garbage decomposition. This is not necessarily bad, for it means that refuse buried over 40 years ago may still be intact and retain much of its original value in the form of energy, fibre or mineral content. As a result, some have proposed landfill mining, whereby the landfill would be opened up, the refuse sorted, and all materials of value recovered. Depending upon market stability and demand, landfill mining might be able to pay for itself, and the action could reopen valuable landfill space and provide the opportunity to install landfill liners and leachate collectors.

Landfills remain the least desirable waste management option; however, there will be a continuing need for these facilities as long as materials are generated that cannot be re-used, recycled, composted or incinerated. It will be the continuing responsibility of MSW managers to operate landfills in a safe and environmentally acceptable manner, encourage waste diversion, and participate in an ongoing planning process to ensure that an adequate supply of landfill space is available.

FUTURE DIRECTIONS IN MSW MANAGEMENT

In Canada, waste management concepts tend to follow one of two philosophies. On the one hand, there is support for government leadership in setting and enforcing strong waste management regulations. On the other hand, there is evolving and strengthening support for a deregulated system in which the actual environmental and economic costs of waste disposal are allowed to drive waste management decisions.

A. The Ontario Experience

Ontario's mandatory blue box program is an example of MSW management driven by government policy. It cannot be denied that Ontario's blue box program has been a success in urban areas, where it now has the potential to divert recyclable materials from landfills at a cost saving to the taxpayer. The decision-makers did not, however, consider the economic and environmental burden this program would represent for small isolated towns that previously managed MSW at much lower cost. The program also had the effect of promoting recycling at the expense of more environmentally friendly alternatives. Indeed, it can be argued that promoting the blue box program as environmentally correct, while hiding its true costs in property taxes, has actually had the effect of increasing the production of single-use packaging materials.

B. The German Experience

The German government has demonstrated strong leadership in regulating MSW management. In 1991, Germany enacted the *Ordinance on the Avoidance of Packaging Waste*, a law that requires manufacturers, distributors and retailers to take full responsibility for their packaging. Under this law, manufacturers and distributors must take back all packaging used in product transportation, and retailers must take back all secondary packaging; for example, the box around a tube of toothpaste. The ordinance specified interim recycling rates for 1993 for seven types of packaging and set the July 1995 collection rate for these materials at 80%. In order to comply with this law, approximately 600 businesses in the distribution chain established an independent company, Duales System Deutschland (DSD), to manage packaging waste. Each participating business pays DSD a fee, according to packaging type, which entitles the company to place a green dot on the packaging material to be collected, sorted and arranged for recycling by DSD.

This system of waste packaging management, which appears to respond to the popular "polluter-pay" principle, has received praise from many quarters and has been described as a model for other countries. The system has one tremendous disadvantage, however: its enormous cost. While Ottawa-Carleton's blue box program costs $172 per tonne, the DSD program costs over $603.(7) Whether the German manufacturer absorbs green-dot fees or passes them on to the consumer, this financial burden puts the manufacturer at a competitive disadvantage in relation to foreign producers who are not subject to German law. Further, Germany cannot ban foreign products or demand that foreign manufacturers participate in the green-dot system as such action would be deemed an unfair trade restriction.

In Germany, the cost of residential garbage collection is not hidden in property taxes. Homeowners pay a set fee for one garbage container and must pay surplus fees for any extra garbage. German citizens have enthusiastically returned packaging materials to DSD collection bins, with the result that green-dot recycling rates are well in excess of those mandated by law. Germany does not yet have the recycling capacity to handle all the packaging waste; this, in turn, has caused a severe distortion of waste material markets in Germany and in neighbouring countries where German packaging wastes are being dumped.(8) The situation became so acute that, in December 1994, the

Parliament of the European Union passed the *Packaging and Packaging Waste Directive* which supersedes German national law and requires the 15 member states to recycle at least 25% of packaging waste, but not more than 45%, by the year 2000.(9)

C. Deregulated Waste Management

The theory behind deregulated waste management is that market and environmental costs can be determined and used to drive a system of waste management that is efficient, economical and minimally harmful to the environment. The first step is to remove the cost of garbage disposal from municipal taxes and to require each household to pay a graduated fee for waste removal in accordance with the waste management hierarchy. The highest fee is paid for refuse going to the landfill, and there is a surcharge for more than one unit of refuse per week. There is a lower levy for each container of material destined for recycling. Thus, there is a financial incentive for the householder to divert as much material as possible from the landfill, and also an incentive to limit the volume of materials for recycling. Such a system encourages "at-home" composting of vegetative wastes, the donation of re-usable materials to charitable organizations and, of most importance, greater participation in return-for-deposit re-use schemes.

Such a system is not without its disadvantages. It is difficult to apply to apartment dwellers, particularly those who rent; it provides a greater inducement to dump illegally; it is more labour intensive, as each household must be directly charged for waste removal; and it may require greater enforcement of anti-dumping regulations. In spite of these drawbacks, this system is beginning to be used in a number of jurisdictions, primarily in Europe and some test cities in the United States. For example, Seattle has a direct charge per bag and a surcharge for additional bags of landfill garbage. No charge is levied for recyclable materials, however, as it is feared this might discourage early recycling efforts.

DISCUSSION

From World War II to the mid-1980s, Canadian MSW management has meant essentially one thing, disposal in a landfill. Rapidly filling landfill sites, coupled with strong public resistance to the establishment of new ones, has necessitated a change in waste management thinking. While recycling enjoys high public approval, it is unlikely that mandated recycling will offer anything more than a one-dimensional solution. Indeed, recycling promoted without full consideration of the economic and environmental implications may hinder the growth of more worthwhile MSW management options. The long-term answer to the successful management of MSW will most likely be an integrated system that recognizes the value of informed consumer choice; green product and packaging design; re-use, recycling, and waste-to-energy incineration of materials; and the continuing need for landfills. "Finding a way to use full-cost pricing so that decisions are decentralized and quickly adaptable will be the key to achieving thoughtful use of resources and improvements in environmental quality."(10)

(1) S. Fairlie, "Long Distance, Short Life, Why Big Business Favours Recycling," *The Ecologist*, Vol. 22, 1992, p. 276-283.

(2) B. Reguly, "Blue Boxes: Why They Don't Work," *Financial Times of Canada*, Vol. 80, 3 February 1992, p. 1,4.

(3) *Ibid.*

(4) C. Hendrickson, *et al.*, "Time to Dump Recycling?," *Issues in Science and Technology*, Vol. 11, 1995, p. 79-84.

(5) Conversion factor $1 US = $1.30 CDN

(6) Manitoba Department of Environment, Waste Reduction and Prevention Branch, *Report of the Waste Reduction and Prevention Committee on Used Tires*, April 1991, p. 5-7.

(7) C. Boerner and K. Chilton, "False Economy: The Folly of Demand-Side Recycling," *Environment*, Vol. 36, 1994, p. 6-33.

(8) J. Rose, "New European Recycling Rules to Curb German Efforts," *Environmental Science and Technology*, Vol. 29, 1995, p. 74A.

(9) *Ibid.*

(10) Hendrickson (1995).
